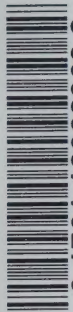


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Ontario Centres of Excellence

***Research  
Directory  
1993-94***





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# CENTRES OF EXCELLENCE DIRECTORY

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# TECHNOLOGY ONTARIO

Technology Ontario was established in 1986 to enhance Ontario's national and international industrial competitiveness. This objective is achieved through technological innovations involving increased collaboration between Ontario's industries, universities and research institutions.

It is comprised of nine innovative programs ranging from the Centres of Excellence, created to strengthen the research linkages between industry and universities, to the Technical Personnel Program, designed to help small companies hire engineering staff to pursue and commercialize technical innovations.

Administered by the Ministry of Economic Development and Trade, Technology Ontario represents a major financial commitment by the Government of Ontario. It is also a recognition that government can play a key role in encouraging greater private-sector research and development, and in coordinating and focusing R&D resources.

The goals of Technology Ontario are:

- to enhance the linkages between industry, labour, universities, and government in scientific areas of strategic importance to Ontario;
- to increase the development and export of advanced, high-value products and services;
- to expand the market within Ontario industry and the research community for people with advanced technical skills and research capabilities, while encouraging more students to pursue research careers; and
- to strengthen public awareness and understanding of the importance of science and technology in wealth creation and in turn the ability to support the social services important to our standard of living.

The programs of Technology Ontario are:

- Centres of Excellence
- Industry Research Program
- Technical Personnel Program
- University Research Incentive Fund
- Technology Adjustment Research Program
- Radarsat
- International Research and Development Agreements
- Research and Development Super Allowance





# THE ONTARIO CENTRES OF EXCELLENCE

## AN INTRODUCTION

The seven Ontario Centres of Excellence were launched in June 1987 in an effort to make the Ontario economy more internationally competitive through the advancement of scientific knowledge and technical innovation. The Centres provide Ontario universities and companies with a window on global technological advances and provide a focal point for research in crucial disciplines.

The Ontario Centres of Excellence are designed to build on existing strengths in post-secondary institutions and industry that are international in stature. Similar and complementary strengths are combined into a "Centre" of international standing. Centres transcend usual institutional boundaries and can be comprised of individuals, departments, or faculties as well as industrial and government laboratories.

Typically, a Centre consists of a consortium of industry and university research units that have recognized international excellence in a field of science considered to be of potential economic benefit to Ontario. The results of their collaboration will be of long-term benefit to industry and will ensure that Ontario's future research and international industrial competitiveness is assured.

The Centres, build upon existing research excellence and areas of demonstrated and potential strength, are dedicated to long-term research that marries economic and intellectual strategies.

Areas of research at the seven Centres are:

- Laser and lightwaves
- Space and terrestrial science
- Manufacturing technology and methods
- Groundwater research
- Information technology
- Materials
- Telecommunications technology

The Centres create a valuable infrastructure because they create new linkages between universities and industries. Consequently, the Centres research priorities are shaped by the priorities of their industrial members.

Within each Centre, the Board of Directors, comprising industry and academia, approve projects. Projects must demonstrate excellent research, contribute to the training of graduate students, and be relevant to the needs of industry in the long term.

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*The Index for the Centres of Excellence Directory is designed to help you locate information about a subject or a specific research area at one or more of the Centres of Excellence. The item or subject you are seeking is listed in general terms, with subheadings listed below. Please turn to the page indicated to determine which Centre is involved in a given research area.*

*Specific projects will be listed under the thrust areas of the section for each Centre.*

*If you are just looking for a list of projects done by a particular Centre, please refer to the Table of Contents.*

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# INFORMATION TECHNOLOGY RESEARCH CENTRE

*The Information Technology Research Centre (ITRC) is a university-based institute that promotes fundamental and applied research in all facets of information technology and effectively transfers the results of the research program to Ontario industry, including highly trained graduate students, technology licences and an extensive communications program.*

<u>THRUST</u>	<u>PROJECTS:</u>	<u>PRINCIPAL INVESTIGATORS:</u>
Artificial Intelligence	Computational Studies of Visual and Tactile Perceptual Processes	R. Browse, Queen's University
	Recognizing Handwritten Characters and Other Deformable Objects	G. Hinton, University of Toronto
	Knowledge Base Management Systems	J. Mylopoulos, University of Toronto
	Experimental and Theoretical Studies in Cognitive Science	Z. Pylyshyn, University of Western Ontario
	Biological and Computational Vision	J. Tsotos, University of Toronto
	Control of Discrete-Event Systems	W.M. Wonham, University of Toronto
	Real-Time Optical Flow and Visual Motion Interpretation	A. Jepson, University of Toronto
	Computational Linguistics and Linguistic Style	G. Hirst, University of Toronto
	Automated Reasoning and Planning Techniques	R. Cohen, University of Waterloo
Computer Networks and Communications	EMI in Digital System Interconnections	K. Balmain, University of Toronto
	Management and Debugging of Networks and Distributed Systems	J. Black, University of Waterloo



<b><u>THRUST</u></b>	<b><u>PROJECTS:</u></b>	<b><u>PRINCIPAL INVESTIGATORS:</u></b>
Computer Networks and Communications (cont.)	Video Compression for B-ISDN and Digital Storage Applications	A. Leon-Garcia, University of Toronto
	Broadband Communications: Capacity Allocation, Traffic Characterization and Video Coding	J. Mark, University of Waterloo
	Cryptographic Systems and Implementations	R. Mullin, University of Waterloo
	Network Management of Ethernet Systems	M. Molle, University of Toronto
	CDMA Mobile Cellular Network Performance	S. Pasupathy, University of Toronto
	Colour Image Processing: Techniques, Architectures and Applications	A. Venetsanopoulos, University of Toronto
	Parallel Applications and Their Support on Multiprocessor Systems	K. Sevcik, University of Toronto
	Hierarchical Distributed Processing Architecture	W.M. Loucks, University of Waterloo
	Field Computation in Optoelectronic and Digital Integrated Circuits	Y.L. Chow
Mathematics of Computation	Signal Processing for Recording Channels	G. Gulak, University of Toronto
	Parallelism, Cryptography, and Algorithmic Design	S. Cook, University of Toronto C. Rackoff, University of Waterloo
	Computer-Aided Design of Large-Scale Control Systems	E. Davison, University of Toronto

**THRUST**

Mathematics of Computation  
(cont.)

Microelectronics

**PROJECTS:**

Effective Numerical Solution  
of Differential Equations

Mathematical Tools for  
Science and Engineering  
Problem Solving via Maple

Data Structures and  
Algorithms

Models and Algorithms for  
Verification of Testing of VLSI  
Circuits

High Speed Gallium Arsenide  
Circuits for  
Telecommunications  
Applications

Amorphous Semiconductor  
Devices and New Process  
Technology for Image  
Sensors

Computer-Aided Design of  
VLSI Circuits

Advanced Bipolar Polysilicon  
Emitter and Related Devices

Computer-Aided Design for  
Filters

VLSI Design Automation  
Tools

High Density Field  
Programmable Arrays

Heterojunction Bipolar  
Transistors: Exploration of  
Structure and Material

**PRINCIPAL  
INVESTIGATORS:**

W. Enright, University of  
Toronto

K. Geddes, Universities of  
Waterloo and Western  
Ontario

I. Munro, University of  
Waterloo

J. Brzozowski, University of  
Waterloo

C.A.T. Salama, University of  
Toronto

S. Chamberlain, University of  
Waterloo

M.I. Elmasry, University of  
Waterloo

D. Roulston, University of  
Waterloo

A. Sedra, University of  
Toronto

J. Vlach, University of  
Waterloo

Z. Vranesic, University of  
Toronto

J. Xu, University of Toronto



**THRUST**

Microelectronics (cont.)

**PROJECTS:**Oversampled Analog to  
Digital InterfacesAmorphous Silicon for  
Transducer ApplicationsAlgorithms and Hardware for  
Digital Audio Applications

High-Performance Simulation

High Dose Germanium  
ImplantationEfficient Parallel-Vector  
Approaches for Solving  
Large-Scale Optimization  
Problems in VLSI Circuit  
Layout**PRINCIPAL  
INVESTIGATORS:**B. Leung, University of  
WaterlooA. Nathan, University of  
WaterlooW.M. Snelgrove, University of  
TorontoD.M. Lewis, University of  
TorontoC. Selva Kumar, University of  
WaterlooA. Vannelli, University of  
WaterlooSoftware Systems and  
GraphicsSurface Creation and  
Manipulation SoftwareStudies in Distributed Group  
InteractionAnimated User Interfaces for  
Real-Time Visualization of  
Complex SystemsLanguage Design for  
Software ReusabilityThe Modelling and Rendering  
of Visually Complex  
Spatiotemporal PhenomenaSoftware Life-Cycle  
TechnologyHeterogeneous Database  
AccessR. Bartels, University of  
WaterlooW. Buxton, University of  
TorontoW. Cowan, University of  
WaterlooG. Cormack, University of  
WaterlooE. Fiume, Universities of  
Toronto and WaterlooR. Holt, Universities of  
Toronto and Queen'sP. Larson, Universities of  
Waterloo and Queen's

**THRUST**

Software Systems and  
Graphics (cont.)

**PROJECTS:**

Querying and Visualizing  
Software Objects

Parallel Applications and their  
Support on Multiprocessor  
Systems

Designing for Users with  
Animated CASE Tools

Flexible Text Visualization

Special Research Projects

Array-Based Programming

**PRINCIPAL  
INVESTIGATORS:**

A. Mendelzon, University of  
Toronto

K. Sevcik, University of  
Toronto

M. Mantei, University of  
Toronto

F.W. Tompa, University of  
Waterloo

M. Jenkins, Queen's  
University

**For more information, please contact:**

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# INSTITUTE FOR SPACE AND TERRESTRIAL SCIENCE

*The Institute for Space and Terrestrial Science (ISTS) is an innovative academic and business consortium focused on space and planetary research. ISTS includes five educational and twenty-two industrial business partners/members, and has a special partnership with Toronto's Marc Garneau Collegiate Institute. The Institute's mission is 1) to provide leadership in key areas of multi-disciplinary space and terrestrial science, engineering and education; 2) to stimulate collaborative research, industrial development and technology/knowledge transfer.*

*ISTS is committed to the training and education of the next generation of scientists, engineers and technologists, with significant support for post-graduate, graduate, undergraduate and high school science education.*

<u>THRUST</u>	<u>PROJECTS:</u>	<u>PRINCIPAL INVESTIGATORS:</u>
Environmental Change	Environmental Change Ground Station	R.H. Wiens
	Measurement of Stratospheric Minor Constituents during the Polar Night	R.P. Lowe, University of Western Ontario
	Mesospheric Processes and Change	R.P. Lowe, University of Western Ontario
	LIDAR Atmospheric Studies	A.I. Carswell
	Middle Atmosphere General Circulation Model	J.C. McConnell, York University
	Mechanisms for Climate Change in the Atmosphere	G. Shepherd, York University
	Atmosphere Radiation	R. Nicholls, York University
	Temporal Change and Variability in the Cryosphere Ocean System in the Canadian Arctic	E. LeDrew, University of Waterloo

**THRUST**

Environmental Change  
(cont.)

Resource Management

Human Performance in  
Space

**PROJECTS:**

Cryospheric Parameters

Forest Change

Geomatic Information  
Systems for the Management  
of Agricultural, Forest and  
Mineral Lands

Radar Imagery for an  
Agricultural Monitoring  
System

Forest Species Determination  
by Optical Remote Sensing

Tundra Geology

Ground-Based Radiometer  
(GBR) for Satellite Monitoring  
of Water Resources

Mechanisms of Human  
Spatial Orientation

Visual-Motor Coordination

Visual and Vestibular  
Information

Space-Related Medical  
Applications of Magnetic  
Brain Recording and Vision  
Testing

**PRINCIPAL  
INVESTIGATORS:**

J. Miller, York  
University/E. LeDrew,  
University of Waterloo

J. Miller, York University

L. Morley, PCI Inc.  
P. Howarth, University of  
Waterloo  
J. Miller, York University  
R. Protz, University of Guelph

P. Howarth, University of  
Waterloo  
R. Protz, University of Guelph

J. Miller, York University  
P. Howarth, University of  
Waterloo

J. Miller, York University

F.E. Bunn, Ph.D. Associates/  
R. Protz, University of  
Guelph/B. Goodison,  
Atmospheric Environment  
Service

I.P. Howard, York University/  
K. Money, Canadian  
Astronaut Corps.

O. Bock, H. Ono

L. Harris/K. Grasse, York  
University

D. Regan, York University



**THRUST**

Structures, Materials  
and Robotics

**PROJECTS:**

Protective Coatings for  
Spacecraft Materials

Spacecraft Environment-  
Induced Electromagnetic  
Interference Effects

Smart Adaptive Structures

Autonomous Robotics

Materials Processing in  
Space

Spacecraft-Plasma  
Interactions

Atomic Oxygen Satellite  
Instrumentation

Variable Geometry Truss  
Manipulators

Deep Space

Space Astrophysics  
Research

Space Astronomy Mission  
Support

Jupiter Research with Galileo  
and Other Facilities

Computational Astrophysics  
using the CC-16 LOAP

Laboratory Simulator of  
Planetary Atmospheres

VLBI Systems Research and  
Development

Magnetic Recording  
Research and Development

**PRINCIPAL  
INVESTIGATORS:**

R.H. Prince, York University

R.C. Tennyson, UTIAS

R.M. Measures, UTIAS

G.M. D'Eleuterio, UTIAS

N. Salansky, UTIAS

J.G. Laframboise, York  
University

R.C. Tennyson, UTIAS

P.C. Hughes, UTIAS

J.J. Caldwell/N.R. Evans

J.J. Caldwell

C.C. Cunningham/  
C.D. Anger

J. Caldwell/D. Anthony

J. Caldwell/J. Burt

Collaboration

Collaboration

<b><u>THRUST</u></b>	<b><u>PROJECTS:</u></b>	<b><u>PRINCIPAL INVESTIGATORS:</u></b>
Deep Space (cont.)	The Algonquin Space Complex	Collaboration
	Space Based Very Long Baseline Interferometry	Collaboration
	SGL Technology Commercialization	Collaboration
Instrumentation	Array Detector Support Facility/Calibration Support Facility	A. Hollinger
	Extreme Ultraviolet Source	J. Caldwell/M. Morrow
	Vision System for a Flexible Manipulator Control	A.B. Hollinger, Electro-Optics Laboratory
	Parallel Computer Development	D. Lee
	Infrared Sensors	P. Thomas, ISTS
Small Satellite Payloads	Thermostatic Change AOTF Satellite Measurement	G. Shepherd, York University
	Dynamics and Transport of Mesospheric Ozone	W. Gault, York University D. Tarasick
Closed Cycle Environmental Systems	Closed Cycle Environmental Systems	N. Salansky, UTIAS
	Efficient Energy Supply for Dense Plant Canopies	M. Dixon, University of Guelph



## SPECIAL EQUIPMENT LIST

### Atmospheric Physics Lab

Lidar installation - mobile ruby laser  
atmospheric remote sensing facility  
Rayleigh and ozone dial lidar with colour video  
camera and time lapse recording system  
spectroradiometer  
High resolution Eagle-mounted scanning  
spectrometer  
Solar heliostat - at York University

### Space Geodynamics

Algonquin Space Complex (formerly Algonquin  
Radio Observatory)  
46 Meter Radio Telescope receiving dish  
32-Panel Solar Interferometer

### Electro-Optics Lab

Integrating Sphere - 8 inch diameter with source  
assembly  
VNIR (Visible Near-Infrared Testing) facility  
Focal plane array test system  
Thermal infrared calibration facility  
Isolation tables  
Datacube data acquisition system  
Kiethley 617 electrometer

### Space Technology

Flexible satellite emulator facility (DAISY)  
Flexible space robotic manipulator facility  
(RADIUS)  
Space Simulation Chambers  
Hypersonic Impulse Tunnel  
Composite Structure Manufacturing Facility  
Fibre Optic Sensor Laboratory

### Earth Observations

Field spectroradiometer (REFSPEC)  
Laboratory link to supercomputer in member  
facility  
Image analysis capability for Macintosh  
CASI - Compact Airborne Spectrographic  
Imager

## Human Performance in Space

Rotating Sphere - tests spatial orientation and motion illusions  
Rotating Room - tests spatial orientation and motion illusions  
Helmet-mounted display  
"Hall of Mirrors" infinite optical test facility  
Watsmart three-D visual motor co-ordination laboratory  
SQUID (Superconducting Quantum Interference Device) neuromagnetometer - measures magnetic fields in human brain

## Solar Terrestrial Physics

WIND Imaging Interferometer (WINDII) remote analysis computer  
WINDII instrument - in orbit  
Mesopause oxygen rotational temperature imager (MORTI)  
Toronto airglow all-sky camera (TASAC)  
WAMDII - short-path ground-based Michelson interferometer  
Lidar - at Delaware Observatory  
MF Radar - at Delaware Observatory  
UWOMI-II - University of Western Ontario Interferometer for night-sky studies, at Delaware Observatory  
Near-infrared scanning radiometer

For more information, please contact:

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# MANUFACTURING RESEARCH CORPORATION OF ONTARIO

The Manufacturing Research Corporation of Ontario (MRCO) supports industrial innovation in Ontario by facilitating the transfer of technological advances from the research community to the manufacturing sector. It directly funds and manages fundamental research at Ontario universities, as well as sponsoring research projects relevant to industrial needs. Funding has been provided to manufacturers for research expertise to develop applied technology solutions to manufacturing problems.

By focusing on innovations in advanced technology required to ensure the future competitiveness of Ontario manufacturers in international markets, and by bridging the gap between manufacturers and the research community, MRCO contributes to the development of an innovative, R&D-driven industrial culture in Ontario.

<u>THRUST</u>	<u>PROJECTS:</u>	<u>PRINCIPAL INVESTIGATORS:</u>
Automation	Development of Quality-Driven Process Control System for Food Process	V.J. Davidson, University of Guelph
	Automated Diagnosis of Failures in Robot Joints	R.E. Ellis, Queen's University
	High Performance Robotic Hardware	A. Goldenberg, University of Toronto
	Expert CO <sub>2</sub> Laser Welding System	W.W. Duley, University of Waterloo
	Direct End-Point Control of Assembly Robots Using Integrated Sensors	W.J. Wilson, University of Waterloo
	Vision and Knowledge-Based Robotics and Integrated Manufacturing	A. Wong, University of Waterloo
Design	Casting Design and Analysis	J.A. Goldak, Carleton University
	Stress Analysis of Brazing and Rolling	M. Dokanish, McMaster University



<u>THRUST</u>	<u>PROJECTS:</u>	<u>PRINCIPAL INVESTIGATORS:</u>
Design (cont.)	Development Projects Within Ontario Industry	R.D. Venter, University of Toronto
	Development of Conjugate Thermofluid Models and Algorithms for CAD/CAM Microelectric Component and System	M.M. Yovanovich, University of Waterloo
Management	Plant-Wide Control of Product Quality & Equipment Performance & Profit	T.E. Marlin, McMaster University
	Enhanced Display & Control Techniques for Intelligent Automation & Manufacturing	R.A. Browse, Queen's University
	Distributed Management of Order Life-Cycle Functions	M.S. Fox, University of Toronto
	Fuzzy-Logic-Based Intelligent Management Systems	I.B. Turksen, University of Toronto
	Statistical Methods for Analysis & Control of Reliability	J.F. Lawless, University of Waterloo
	Improved Planning and Control in Ontario Manufacturing	J.B. Moore, University of Waterloo
	Large-Scale Optimization Approaches for Cellular Manufacturing	A. Vannelli, University of Waterloo
	Quality Improvement & Variation Reduction via Experimental Design and Process Control	C.F.J. Wu, University of Waterloo
Process	Open Architecture Manufacturing Systems	M.A. Elbestawi, McMaster University

**THRUST**

Process (cont.)

**PROJECTS:**Computer-Aided Plastics  
ProcessingProduct Property Modelling  
for Polyethelene and  
Polypropylene PolymerizationLaser-Based Photothermal  
N.D. Evaluation

Mechanics of Shot Peening

Differential Flow Induced  
Chemical Instability (DIFI)CI)Development of a  
Comprehensive Design  
Methodology for Adhesive  
JointsFuzzy-Logic-Based Intelligent  
Processor DesignManufacture of Clean Air  
Powered Systems for  
TransportationManufacture of Self-  
Reinforced Plastics

Control of Robotic Welding

Microstructure Control During  
Hot Strip Rolling**PRINCIPAL  
INVESTIGATORS:**J. Vlachopoulos, McMaster  
UniversityK.B. McAuley, Queen's  
UniversityA. Mandelis, University of  
TorontoS.A. Meguid, University of  
TorontoM. Menzinger, University of  
TorontoJ.K. Spelt, University of  
TorontoI.B. Turksen, University of  
TorontoC.A. Ward, University of  
TorontoR.T. Woodhams, University of  
TorontoJ.P. Huissoon, University of  
WaterlooJ.G. Lenard, University of  
Waterloo

**For more information, please contact:**

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## ONTARIO CENTRE FOR MATERIALS RESEARCH

*The Ontario Centre for Materials Research promotes world leadership in the development of materials knowledge in Ontario through research and through the transference of knowledge and technology to industry. The Centre funds industrially relevant research at Ontario universities in: polymers and plastics, biomaterials, metals and ceramics, electronic and optoelectronic materials, and in films, surfaces and coatings. Complementing this research, the Centre supports a range of technology transfer activities.*

<u>THRUST</u>	<u>PROJECTS:</u>	<u>PRINCIPAL INVESTIGATORS:</u>
Biomaterials	Materials for Blood Contacting Devices	J. Brash
	Alternative Crosslinking Techniques	M. Lee
	New Materials for Implants Based on Biodegradation Evaluation	P. Santerre
	Improved Materials for Orthopaedic Implants	C. Hansson
	Development of Implantable Biodegradable Devices	M.F.A. Goosen
	Degradation of Surfaces for Orthopaedic Bearings	J. Medley
	Materials for Engineering Cell Response	J.E. Davies
	Surface Modification of Load Bearing Materials	R. Pillar
Materials for Optoelectronic Devices for Communications	Surface Coatings of Specific Bone Cell Response	M. Sayer
	Optical Waveguides	P.E. Jessop
	Plasma Assisted Deposition of Thin Films for Optoelectronic Applications	P. Mascher

<u>THRUST</u>	<u>PROJECTS:</u>	<u>PRINCIPAL INVESTIGATORS:</u>
Materials for Optoelectronic Devices for Communications (cont.)	Ultrafast Optoelectronics	J.S. Preston
	Fabrication and Characterization of Optoelectronic Device Structures	J.G. Simmons
	MBE Growth of $\text{In}_{1-x}\text{Ga}_x\text{As}_y\text{P}_{1-y}$ on InP and GaAs	D.A. Thompson
	Analytical Electron Microscopy of Strained layer InP-Based Superlattices	G.C. Weatherly
	Theoretical Studies of Engineered Materials and Devices	J.M. Xu
	Numerical Analysis of Optical Waveguides and Optoelectronic Materials	D. Yevick
	Materials Analysis Related to Group IV Semiconductor Technology	A.P. Hitchcock
Materials for ULSI Electronics Devices	Ion Implantation of Group IV Materials	I.V. Mitchell
	Oxidation of Silicon	I.V. Mitchell
	Defect Profiling in Group IV Semiconductors using Variable-Energy Positrons	P.J. Schultz
	Dynamics of Ge/Si Interface Formation	S. Zinke-Allmang
Films, Surfaces and Coatings: Tribology	Study of Antiwear/Extreme Pressure Protective Films on Sliding Surfaces	G.M. Bancroft

<u>THRUST</u>	<u>PROJECTS:</u>	<u>PRINCIPAL INVESTIGATORS:</u>
Films, Surfaces and Coatings: Tribology (cont.)	Studies of Al and Al-alloy Oxidation and Lubrication	P.R. Norton
	Study of Antiwear/Extreme Pressure Protective Films on Sliding Surfaces: Interfacial Forces	P.R. Norton
	Performances and Materials Properties (or Antiwear and Extreme Pressure Films)	P.R. Norton
Thin Film Deposition and Processing Techniques	Theory of Nucleation and Growth of Thin Film Crystallization via RTA	R.J. Gooding
	Effect of Excimer Laser Treatment on Adhesion in Coated Sheets	T.H. North
	Organo-Metallic Chemical Vapour Deposition of Metals and Ceramics on Metal, Semiconductor, Composite and Polymer Substrates	R.J. Puddephatt
	Ceramic Coatings for Functional Application	M. Sayer
Candu Tube Technology	Studies on Zr and Zr-alloy Surfaces relevant to CANDU Pressure Tube Behaviour	P.R. Norton
	Microstructural Evolution and Mechanical Properties of Microalloyed Steels	J.D. Boyd
	Production and Properties of Fine Grained Magnesium Alloys	J.D. Embury
	Laser Welding	W.W. Duley/H.W. Kerr/ D.C. Weckman



<u>THRUST</u>	<u>PROJECTS:</u>	<u>PRINCIPAL INVESTIGATORS:</u>
Metal Processing (cont.)	Physical and Mechanical Properties of Coated Sheets Appropriate for Downstream Processing	S. Saimoto
Ceramics and Concrete	Durability of Concrete	C.M. Hansson/R.D. Hooton
	Functionally Graded Ceramic Laminates	D.S. Wilkinson
Metals and Ceramic Composites	Microstructure and Mechanical Properties of Dual Phase Materials	W.E. Baker/J.D. Boyd
	Friction Welding of Aluminum-Based MMCs to Conventional Aluminum Alloys and to Steel	T.H. North
	Interfaces in Metal and Ceramic Matrix Fibre Composites	M.R. Piggott
Recycling and Environmental Impact of Metals and Composites	Injection Technology for Recycling	G.A. Irons
	The Utilization of Slags in the Construction Industry	W.-K. Lu
	Kinetic Study of the Removal of Heavy Metals from Steelmaking Dust by In-Flight Reduction in H <sub>2</sub> and CO	C. Pickles
	Recovery of Lead Values from Lead Blast Furnace Slags	J.M. Toguri
High Critical Temperature Superconductors	Theory on Oxide Superconductors	J.P. Carbotte

<u>THRUST</u>	<u>PROJECTS:</u>	<u>PRINCIPAL INVESTIGATORS:</u>
High Critical Temperature Superconductors (cont.)	New Layered Oxides for Superconducting Devices	J.E. Greedan
	Crystal Growth of Substrates for High $T_c$ Films	J.E. Greedan
	Electronic Properties of New Metallic Materials	C. Kallin
	High Temperature Superconductors by Laser Ablation	T. Timusk
Cellular Materials	Mechanical Response of Cellular Materials	J.D. Embury
	Generation, Processing and Mechanical Properties of Cellular Materials	J.M. Toguri
Novel Structures	Interphase and Nanophase Engineering	U. Erb
	High Resolution X-Ray Scattering Laboratory	B. Gaulin
	New Inorganic Polymers for Advanced Engineering Applications	G.J. Vancso
	Quasicrystals and Quasicrystalline Thin Films	G.C. Weatherly
Polymer Synthesis and Kinetics	Design of High-Performance Polymer-Supported Chelating Agents for Heavy Metals Separation and Removal	M. Gauthier

<b><u>THRUST</u></b>	<b><u>PROJECTS:</u></b>	<b><u>PRINCIPAL INVESTIGATORS:</u></b>
Polymer Synthesis and Kinetics (cont.)	Production Technology for Manufacture of Speciality Polymers by Emulsion, Suspension and Inverse Micro Suspension Polymerization	A.E. Hamielec
	Polymerization Kinetics, Modelling and Property Relationships: Productivity and Quality Enhancements	A. Penlidis
	Functional Polymer Systems	H.D.H. Stover
Composites, Recycling and Blends of Plastics	New Engineered Materials from Discarded Polymers	W.E. Baker
	Wood Fibre Composites	J. Balatinecz
	Carbon/Carbon Composites	A.A. Haasz
	Thermoplastic Composites	J.S. Hansen
	Smart Composite Materials	R.M. Measures
	Mesostructure in Fibre Composites	M.R. Piggott
	Protective Coatings for Advanced Fibre Reinforced Composite Materials	R.C. Tennyson
	Interface Structure in Polymer Blends	M.A. Winnik
Simulation	Monitoring and Control of Quality for Recycled Plastic Waste	S. Balke
	Viscoelastic Modelling of Polymer Processing	E. Mitsoulis



<b><u>THRUST</u></b>	<b><u>PROJECTS:</u></b>	<b><u>PRINCIPAL INVESTIGATORS:</u></b>
Simulation (cont.)	Chemical Modification of Polymers through Reactive Extrusion	C. Tzogannakis
	High Precision Polymer Extrusion	J. Vlachopoulos
Materials Science of Plastics	Impact Behaviour Enhancement of Glassy Plastics	A. Plumtree
	The Microstructural Basis of Predicted Service Lifetime in Processed Polymers	D.M. Shinozaki
	Mechanisms of Toughened Polystyrene Examined by Small Angle X-Ray Scattering and Precision Strain Rate Sensitivity	M.A. Singh

#### **SPECIAL EQUIPMENT LIST**

Biomaterials	Microtome
	Biaxial Testing System
	Clean Room
	Tissue Culture Lab
	ESCA/SIMS Spectrometer
Metals and Ceramics	Crystal Growth Facility
	Kevex PSI X-Ray Detector
	Computer Automated Netzsch TGA/DTA
	Hot Isostatic Press
	Particle Size Analysis and Surface Area

## Metals and Ceramics (cont.)

Measurement Equipment

Vacuum Hot Press

Furnace and Mixing Equipment

Mechanical Response Unit

Squid Magnetometer

Chemical Deposition Equipment

Magnetron Sputtering Unit

NDE Unit for Ceramics Characterization

High Intensity Rotating Anode X-Ray Generator

Image Analyser

OHNO Caster

Corona Arc Generator

Polymer Spinning System

Nd-YAG Laser

## Optoelectronics

Argon Ion Laser

Plasma Etcher

Molecular Beam Epitaxy (MBE) System

Oxide/Nitride Deposition System

## Polymers and Plastics

Twin Screw Extruder

Beckman Ultracentrifuge

Rheometrics Instrumented Impact Tester

Rheomix Melt Reactor

Differential Scanning Calorimeter with Pressure Cell

**Polymers and Plastics (cont.)**

Optical Waveguide Spectrometer

SEC Composition Detector and Statistics  
Computer

Differential Refractometer

Magic Angle Spinning Probe (NMR)

Picosecond Fluorescence Decay Spectrometer

Differential Viscometer

Quasielastic Light Scattering Equipment

Gas Chromatograph

Ultrasonic Flow Detector and Tracking System

Environmental Chamber

NMR Spectrometer

**Films, Surfaces and Coatings**

FTIR Spectrometer and Gas Chromatograph

Double Crystal Monochromator on Synchrotron

Particle Accelerator, Beam Line and Target  
Chamber

**For more information, please contact:**

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# ONTARIO LASER AND LIGHTWAVE RESEARCH CENTRE

*The mission of the Ontario Laser and Lightwave Research Centre (OLLRC) is to perform and promote laser and lightwave research in Ontario, to train world-class researchers and to encourage the transfer and diffusion of technology to industry. This mission is achieved through a multi-disciplinary research program, the operation of the OLLRC Facility with linkages to industry, government and universities, and an active communications program.*

<u>THRUST</u>	<u>PROJECTS:</u>	<u>PRINCIPAL INVESTIGATORS:</u>
Biomedical Applications of Lasers	Optical Diagnostics	B. Wilson, Ontario Cancer Treatment Centre/Princess Margaret Hospital - Ontario Cancer Institute
	Laser Hyperthermia/ Photocoagulation	B. Wilson/ M. Patterson/D. Wyman, Ontario Cancer Treatment Centre/Princess Margaret Hospital - Ontario Cancer Institute
	Medical Laser Systems	B. Wilson/M. Patterson, Ontario Cancer Treatment Centre/Princess Margaret Hospital - Ontario Cancer Institute
Frontiers of Device Development	Clusters and Interfaces	S. Wallace/J. Polanyi/ H. van Driel/M. Moskovits/ C. Goh/S. John, University of Toronto
	Nanostructures	M. Moskovits/S. John/ S. Wallace/J. Sipe, University of Toronto
	Excited Photoemission and Quantum Confined Devices	M. Moskovits, University of Toronto
	Fast Response Photorefractive	S. Wallace, University of Toronto
	Scanning Tunnelling Microscopies	M. Moskovits, University of Toronto

**THRUST****PROJECTS:****PRINCIPAL  
INVESTIGATORS:**

Photonic Science and  
Technology

Optoelectronic Device  
Development

P. Smith, University of  
Toronto/J. Xu, University of  
Toronto

Fast Organic Crystal  
Modulators

K. Iizuka, University of  
Toronto

Ultrafast Photonics

P. Smith, University of  
Toronto

Quasi Isotropic Modulators

D. May, University of Toronto

New Optoelectronic Materials  
and Devices

G. Kenney-Wallace/  
H. van Driel, University of  
Toronto

Quantum Optics of  
Condensed Materials

J. Sipe, University of Toronto

Novel Photodynamic Laser-  
Matter Interactions

Molecular Dynamics

P. Brumer/S. Wallace,  
University of Toronto

Light and Matter Coherence  
Phenomena

P. Brumer/S. Wallace,  
University of Toronto

Rare-gas Excimer Lasers

B. Stoicheff, University of  
Toronto

High Intensity Laser Matter  
Interaction

P. Herman/R. Marjoribanks,  
University of Toronto

Quantitative Spectroscopies  
for Environmental Studies

D. May/J. Drummond,  
University of Toronto

Guided Wave Technology

Fibre Optic Smart Structures

R. Measures, University of  
Toronto

Non Linear Excitation of  
Grating Structures

J. Sipe, University of Toronto

Optical Fault Locator

K. Iizuka, University of  
Toronto

# ONTARIO LASER AND LIGHTWAVE RESEARCH CENTRE RESOURCE FACILITY

*A unique feature of the OLLRC is the Resource Facility which enables Ontario industries to compete in the new international market place. Through its services, the Resource Facility encourages industries to launch new technologies, exploit new opportunities, develop marketable products, and promote strong new partnerships with universities and government. To assist industries, the Resource Facility provides access to a broad range of modern instrumentation, engages in contract research, loans equipment for off-site use, supplies consultation and training services and conducts workshops and professional development courses.*

## **Lasers**

CW Mode-locked Nd:YAG Laser

CW Mode-locked Cavity-dumped Dye Laser (2)

Argon Ion Lasers

Helium-Cadmium Laser

Excimer Lasers (2)

Nd-YAG Lasers (3)

CW Nd:Yag Laser, 20W multimode and 3W TEM<sub>00</sub>

Pulsed Dye Laser (3)

Nd-Yag Laser

Titanium-Sapphire Laser

## **Detectors**

Indium Gallium Arsenide Photodiodes

Silicon Photodiodes

Mercury Cadmium Telluride detectors

## **Diagnostic Equipment and Data Collection**

Photon Counting Equipment

Wavemeter

Pulsed Wavemeter



Diagnostic Equipment and Data Collection  
(cont.)

Digital Oscilloscopes

Pulse Power Meters (4)

Digital Power Meters

Excimer Power Meter

Beam Profilometer

Optical Accessories

CCD Camera

Spectroscopic System

Complete Macro-Micro Probe Raman System  
SPEX 1877 B Triplemate Spectrometer,  
Automatic Data Collection, Single Channel.  
Krypton laser operating at 752 nm and 530 nm  
available in near future.

Time-correlated single photon counting system  
(to be used with CW mode-locked dye laser) for  
fluorescence detection.

FTIR Spectrometer

Monochromator

Fibre Optics

A variety of singlemode/multimode fibres,  
sources, detectors and accessories to do  
various feasibility experiments with fibre optics.

Fusion Splicer (multi/single mode fibres,  
rotation stage for polarization preserving fibres)

Single-mode fibre optic delivery system

Lightwave Systems

Thermal Imaging System (AGEMA 880 Long  
Wavelength Scanner with BURST capability).

Confocal Scanning Microscope

**For more information, please contact:**

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# TELECOMMUNICATIONS RESEARCH INSTITUTE OF ONTARIO

*The goal of the Telecommunications Research Institute of Ontario (TRIO) is to create world class telecommunications technology relevant and transferable to Canadian industry, while increasing the flow of trained researchers in relevant areas. This is achieved by enhancing the technological competitiveness of Canadian telecommunications companies through shared research in university/industry partnerships.*

*Special attention is given to expanding and enhancing the educational infrastructure to achieve a permanent increase in quality and capability of TRIO member universities.*

<u>THRUST</u>	<u>PROJECTS:</u>	<u>PRINCIPAL INVESTIGATORS:</u>
Protocols and Software Engineering	Validation-Directed Software Engineering	R. Probert, University of Ottawa
	Telecommunications Software Engineering	D. Parnas, McMaster University
	Telecom Software Methods	M. Woodside, Carleton University
	Dependable Software Systems for Telecommunications Applications	G. MacEwen, Queen's University
	Combined LOTOS Toolset	L. Logrippo, University of Ottawa
Mobile and Satellite Communications	Mobile and Satellite Communications	P. McLane, Queen's University
	Digital Communications	P. McLane, Queen's University
	Mobile and Portable Radio Networks	S. Mahmoud, Carleton University
	VLSI in Communications	M. Copeland, Carleton University
	Secure Wireless Communications	S. Tavares, Queen's University



<u>THRUST</u>	<u>PROJECTS:</u>	<u>PRINCIPAL INVESTIGATORS:</u>
Mobile and Satellite Communications (cont.)	Radio Coding and Diversity	N. Beaulieu, Queen's University
Antennas and Signal Processing	Array and Signal Processing for Communications	M. Wong, McMaster University
	Hands Free Telephony	J. Reilly, Carleton University
	Integrated Phased Array Antennas	J. Litva, McMaster University
	Digital Beamforming	J. Litva, McMaster University
	Neural Networks for Signal Processing	H. Hafez, Carleton University
	Millimetre Wave Antennas and Feeders	J. Wright, Carleton University
	Regenerative Digital Satellite System	J. Litva, McMaster University/ P. McLane, Queen's University
Very High Speed Circuit Design and Testing	Very High Speed Circuit Design and Testing	M. Ney, University of Ottawa
Photonic Networks and Systems	Optical Network Architectures	M. Kaverad, University of Ottawa
	Optical Network Protocols	T. Todd, McMaster University
	Optical Network Access Technology	J. Cartledge, Queen's University
	Optical Interconnections for WDM Communication Systems	W. Huang, University of Waterloo

**THRUST**

Enterprise Networks

**PROJECTS:**

Interconnected Networks for  
Multimedia Traffic

Multimedia Communications

Broadband Packet Switching  
Networks

Fault Management of  
Networks

**PRINCIPAL  
INVESTIGATORS:**

R. Kaye, Carleton University

N. Georganas, University of  
Ottawa

H. Mouftah, Queen's  
University

B. Pagurek, Carleton  
University

**For more information, please contact:**

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340 March Road  
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# WATERLOO CENTRE FOR GROUNDWATER RESEARCH

*The Waterloo Centre for Groundwater Research is a university based institute focusing on the development and protection of groundwater resources, and the implications of substance waste management on groundwater quality. This is achieved through pursuing a fundamental understanding of the processes that govern the occurrence and quality of groundwater resources.*

*The Centre promotes the development of the Ontario advanced technology groundwater industry while, fostering international awareness of Ontario and Canadian groundwater technology and expertise.*

<u>THRUST</u>	<u>PROJECTS:</u>	<u>PRINCIPAL INVESTIGATORS:</u>
Remediation of Contaminated Groundwater	Vadose Zone Solute Transport	D. Rudolph, University of Waterloo
	Remediation of Solvents in Soil and Fractured-Rock Systems	J. Cherry, University of Waterloo
	Abiotic Degradation of Organics	R. Gillham, University of Waterloo
Behaviour of Organic Contaminants in Groundwater	Environmental Biochemistry	J. Barker/W. Inniss/ C. Mayfield, University of Waterloo
	Pesticides in Watershed	J. Cherry, University of Waterloo
	Analytical Method for Development for Trace Organics	J. Pawliszyn, University of Waterloo
	Software Development	E. Sudicky, University of Waterloo
	Physical Properties Research	P. Annan, University of Waterloo/Industrial Associate
	Physical Properties Research	J. Greenhouse, University of Waterloo

**THRUST**

Behaviour of Organic  
Contaminants in  
Groundwater (cont.)

Evaluation and Development  
of Groundwater Resources

Groundwater Protection

**PROJECTS:**

Innovative Measurement of  
Genetic Capability of  
Groundwater Using the  
Polymerase Chain Reaction

Geostatistical Analysis of  
Fluctuating Waterlevels at  
C.F.B. Borden Emplaced  
Source Tracer Test Site

Saskatchewan Groundwater  
Flow System

Isotope Geochemistry

Latin American Groundwater  
Resources

Solute Transport in Fractured  
Media

Septic Systems and Impacts  
on Groundwater

Geochemical Modelling

Watershed Hydrology

Watershed Geochemistry

Groundwater Contributions to  
Paradise Lake

Groundwater Resources  
Protection

3D Modelling of Groundwater  
Flow and Transport

**PRINCIPAL  
INVESTIGATORS:**

W. Inniss, University of  
Waterloo

E. Sudicky, University of  
Waterloo

J. Cherry, University of  
Waterloo

T. Edwards/S. Frape/  
S. Schiff, University of  
Waterloo

R. Farvolden, University of  
Waterloo

C. Mase, University of  
Waterloo

J. Cherry, University of  
Waterloo

E. Reardon, University of  
Waterloo

S. Schiff/T. Edwards,  
University of Waterloo

S. Schiff, University of  
Waterloo

S. Schiff, University of  
Waterloo

G. Mulamoottil, University of  
Waterloo

E. Frind, University of  
Waterloo



**THRUST**

Groundwater Protection  
(cont.)

**PROJECTS:**

Modular Septic System

Initial Geochemical -  
Hydrogeological Survey of  
the Fresh Water Aquifers in  
S.W. Woolrich Township

Leachate Treatment by  
Septic Systems

Design and Construction of a  
Device for Measuring  
Hydraulic Gradients in Lake  
Bottom Sediment

**PRINCIPAL  
INVESTIGATORS:**

C. Jowett, University of  
Waterloo

S. Frape/J. Greenhouse,  
University of Waterloo

J. Cherry/W. Robertson,  
University of Waterloo

D. Rudolph, University of  
Waterloo

Hydrogeological Aspects of  
Waste Disposal

Mine Environment Research

**For more information, please contact:**

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